

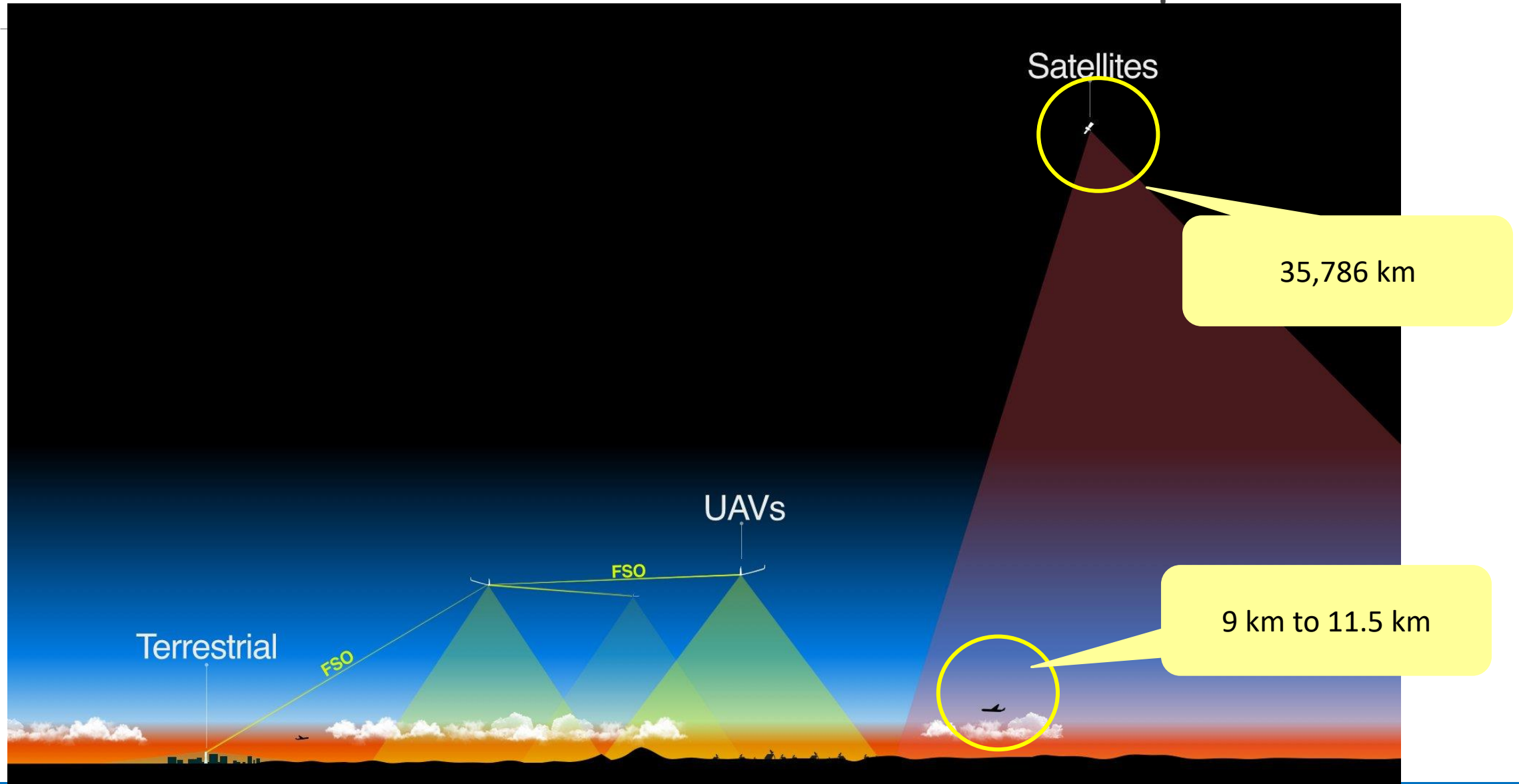
Beginners:

Connectivity in Planes



@3g4gUK

How hard can it be to connect the planes?



How hard can it be to connect the planes?

Low, not slow

If satellite internet is going to take off, orbiters need to fly low to keep data speeds fast

Geosynchronous 35,700 km

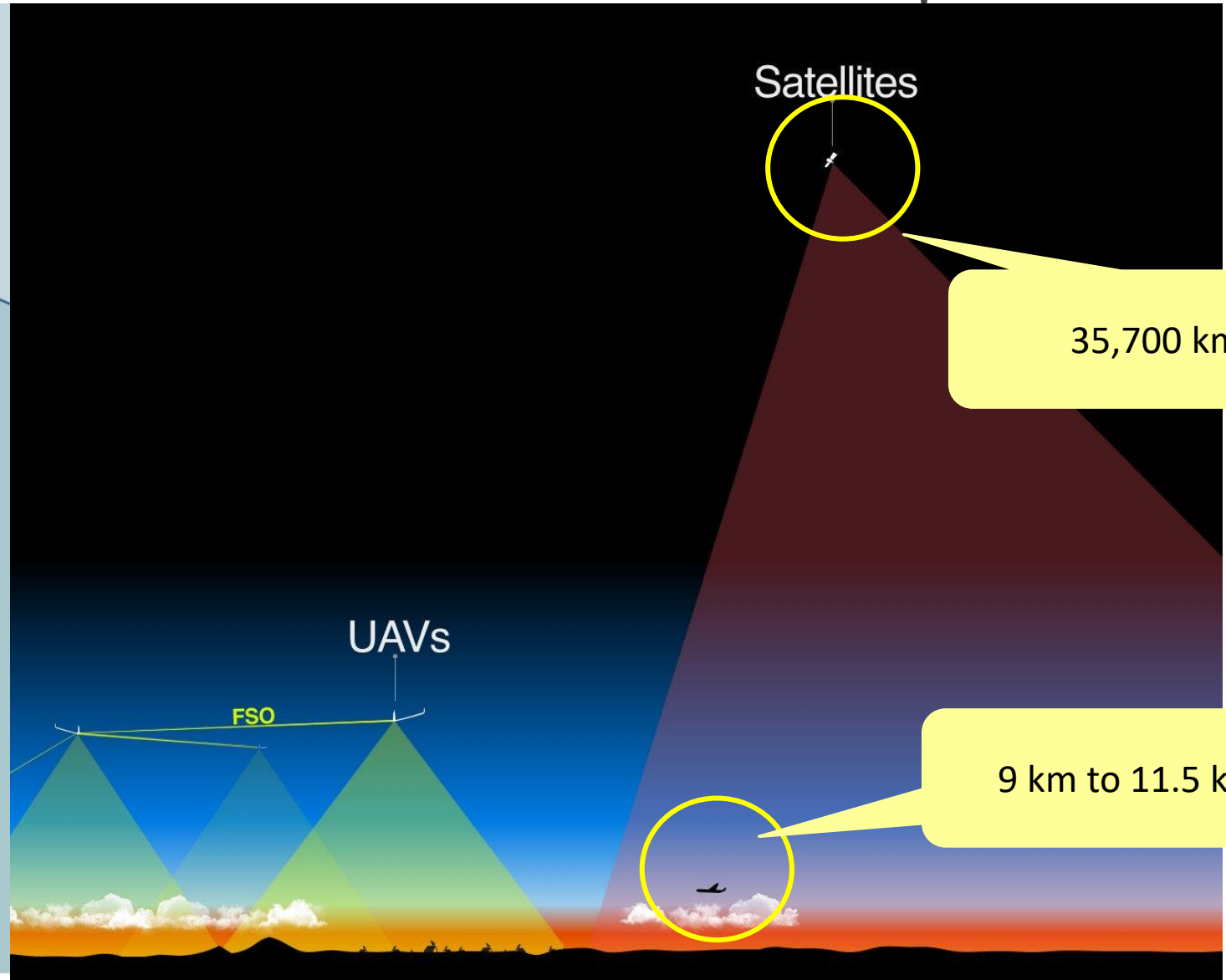
Signals from Earth take 250ms to make the round trip, too long for things like video chat

Medium Earth Orbit 2000-35,700 km

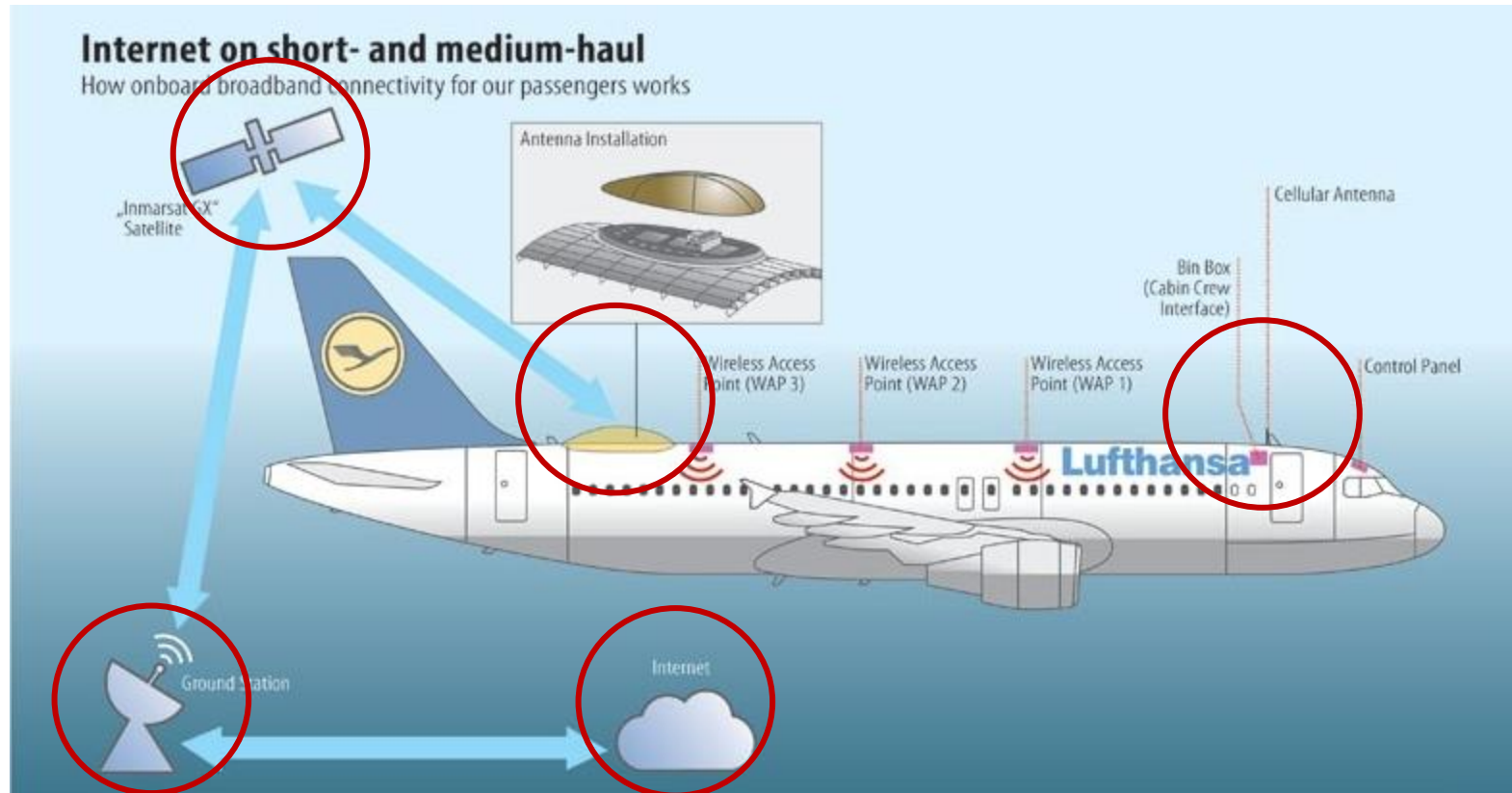
Signal round trips are shorter (52ms at 8000 km), good enough for most internet applications

Low Earth Orbit 180-2000 km

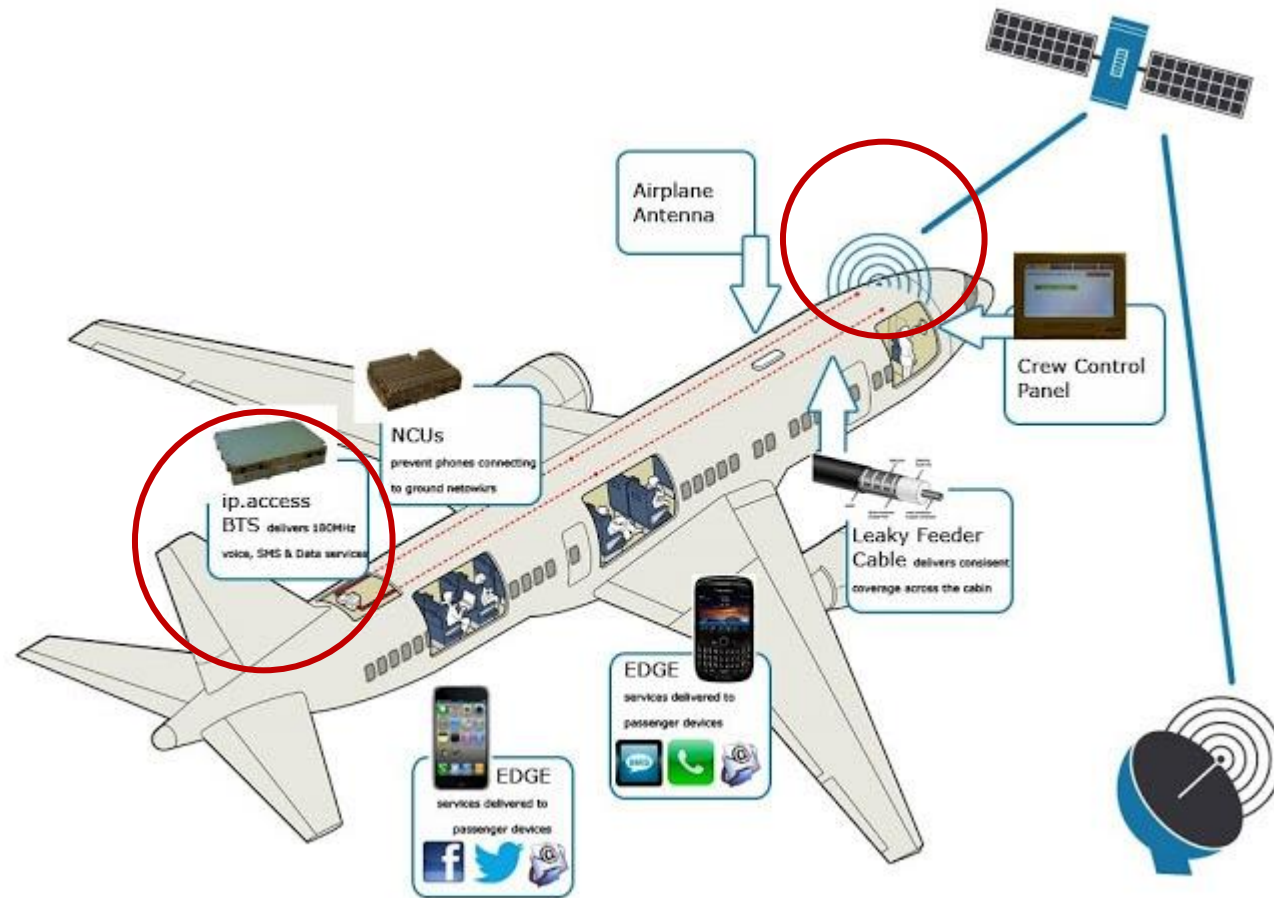
SpaceX, OneWeb and Iridium are all targeting this orbit. Signal round trip times are negligible (~6ms)



Wi-Fi on Planes



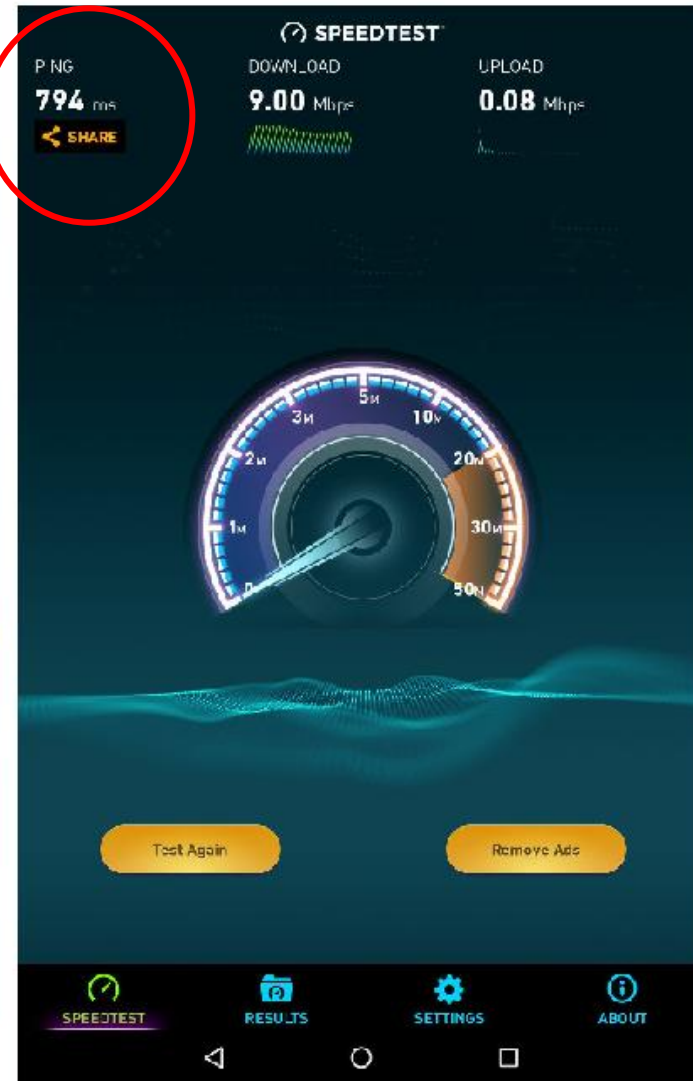
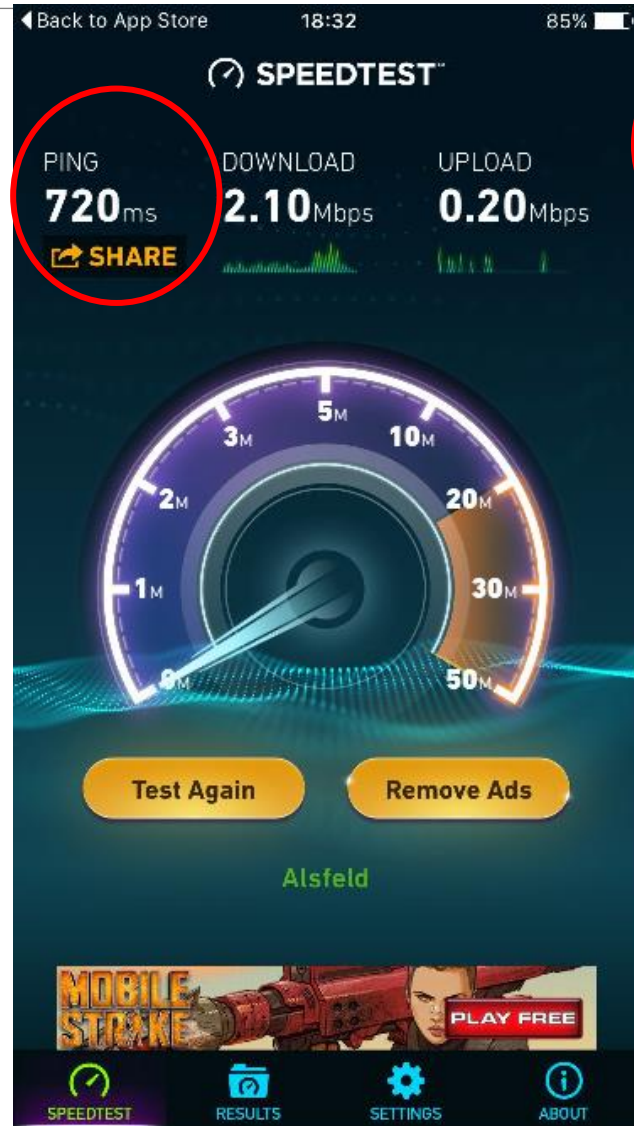
Small Cells on Planes



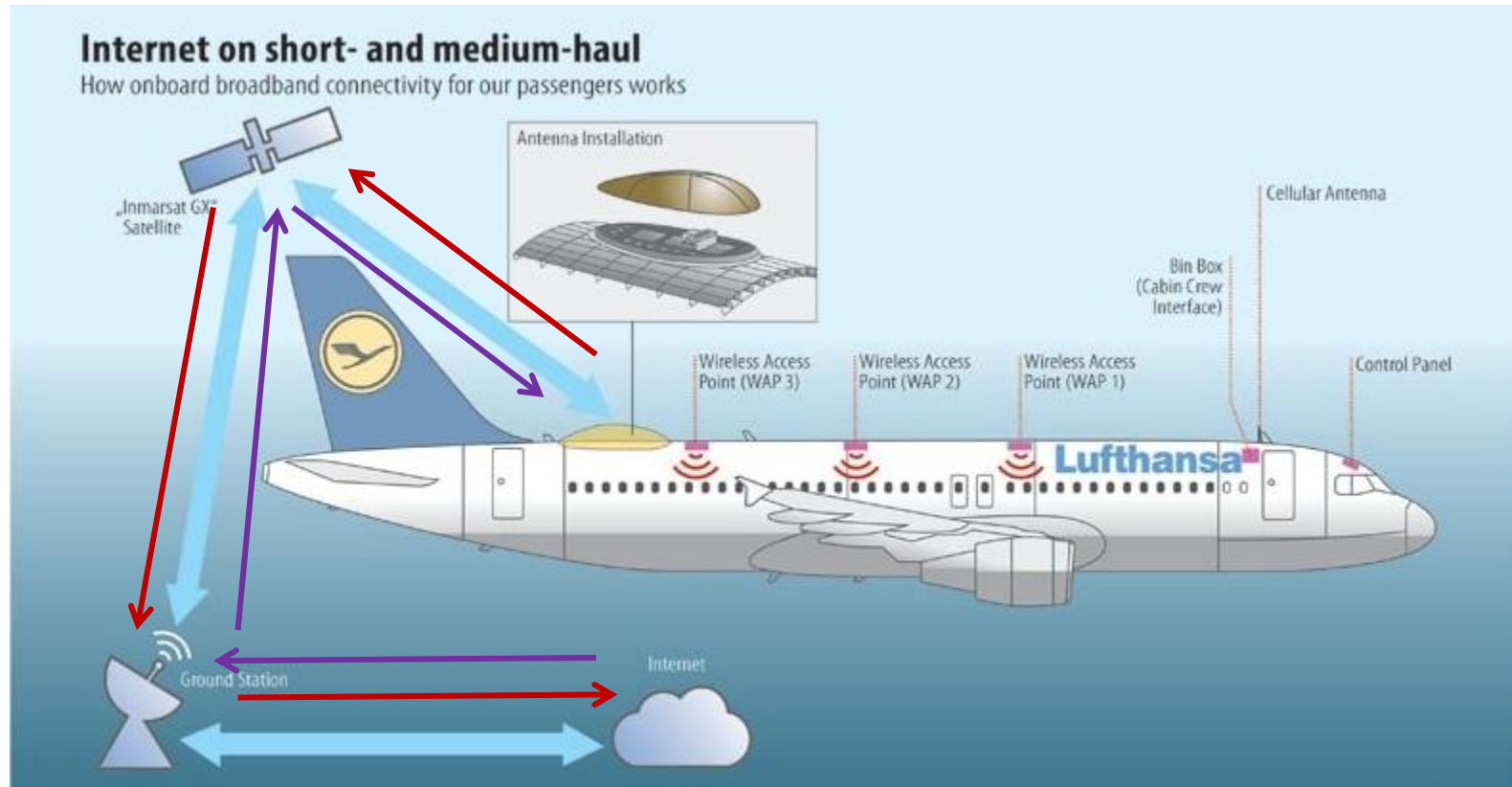
[Source](#)

Old ETSI Whitepaper: '[GSM operation onboard aircraft](#)' makes interesting reading

Speedtest on Plane Wi-Fi



Calculating the latency and ping timing



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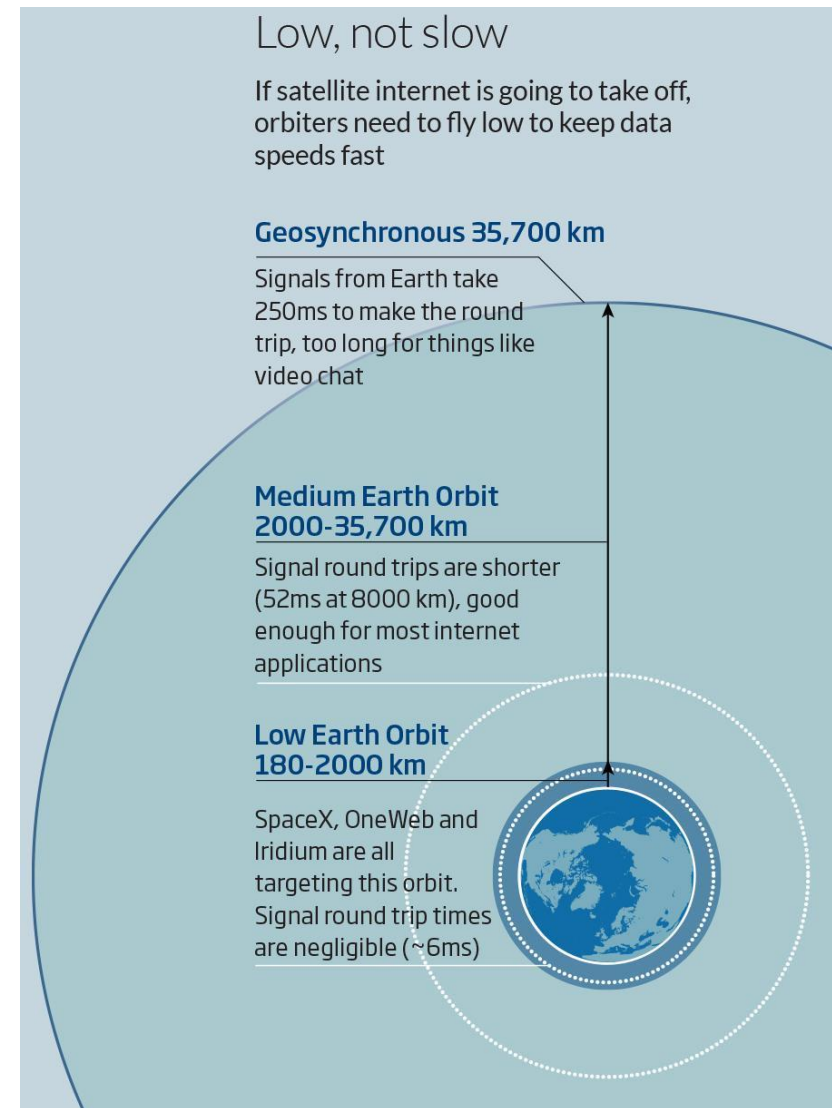
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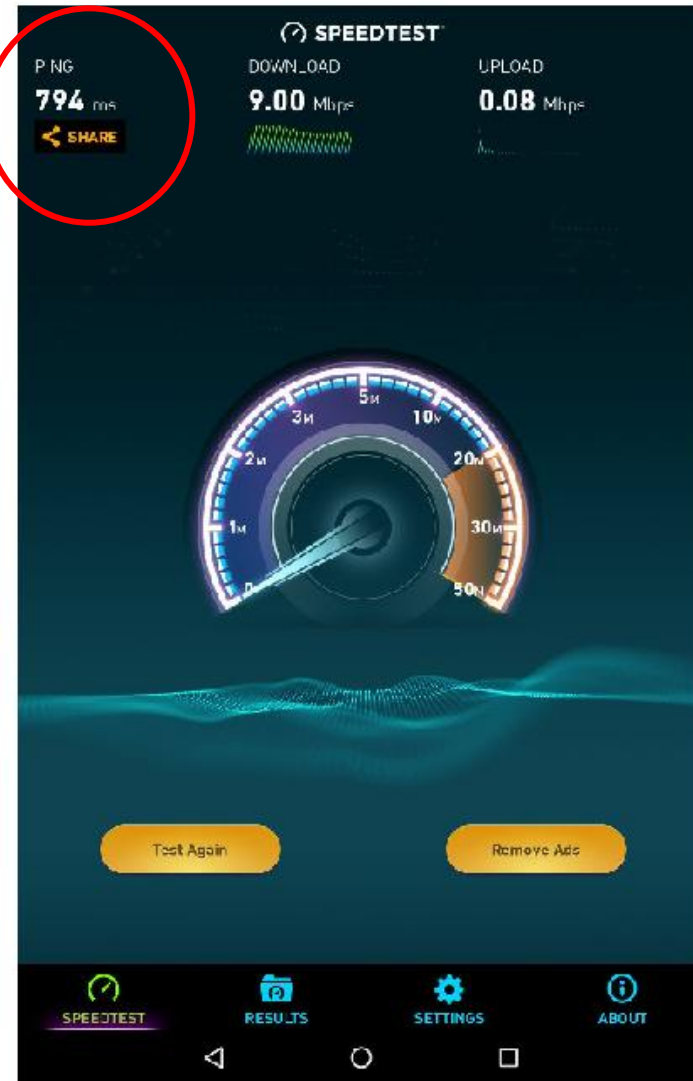
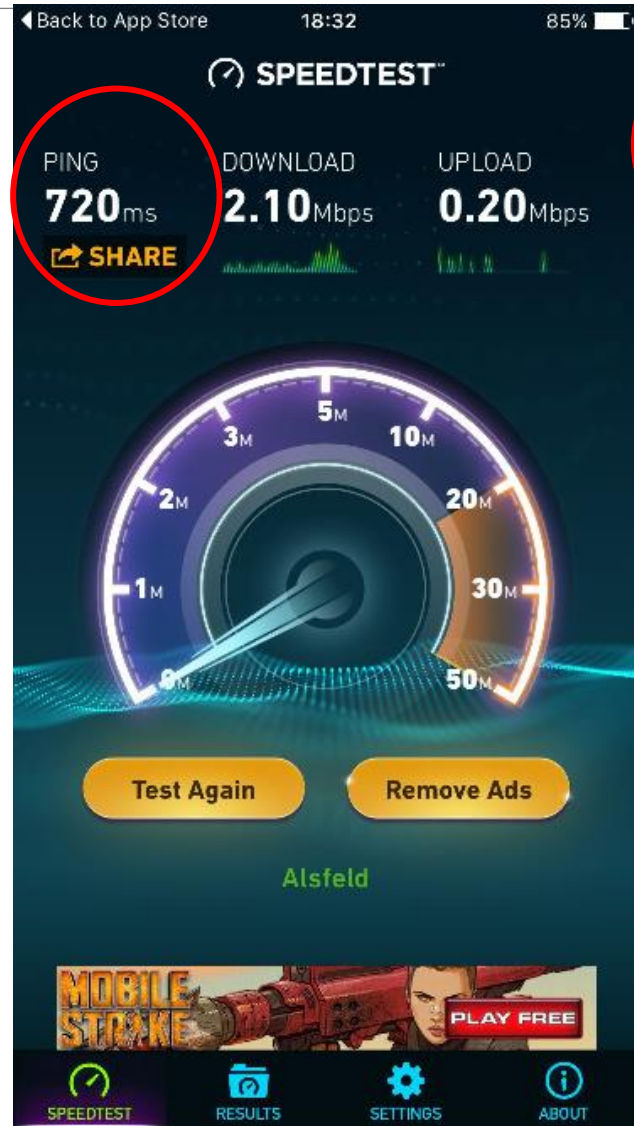
Latency is defined as the time it takes for a source to send a packet of data to a receiver. In simple terms, half of Ping time

Calculating the latency and ping timing

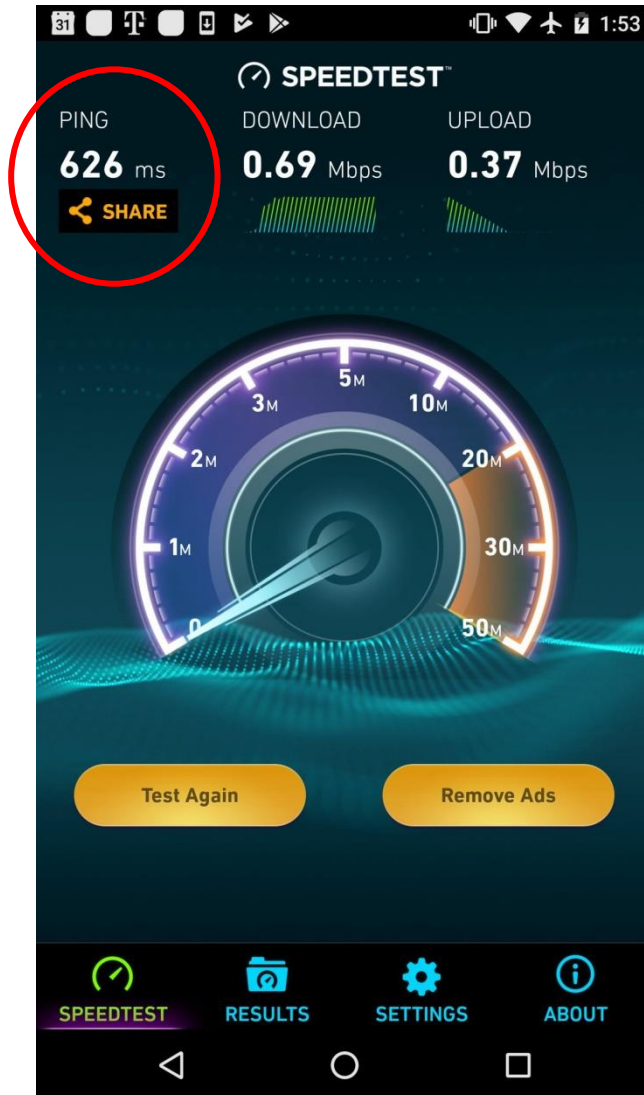
- Speed of light = 3×10^8 m/s or 3×10^5 km/s
- RF signals travel the same speed as light
- Ground station to satellite = $35786 \text{ km} / 3 \times 10^5 \text{ km/s} = 120 \text{ ms}$
- Satellite to plane approx. 120ms
- Ground station to server approx. 10ms
- Plane to WiFi approx 50ms (processing delays)
- Total latency approx. = 300ms
- Ping time, at least 600 ms approx.



Speedtest on Plane Wi-Fi



Speedtest on Plane Wi-Fi



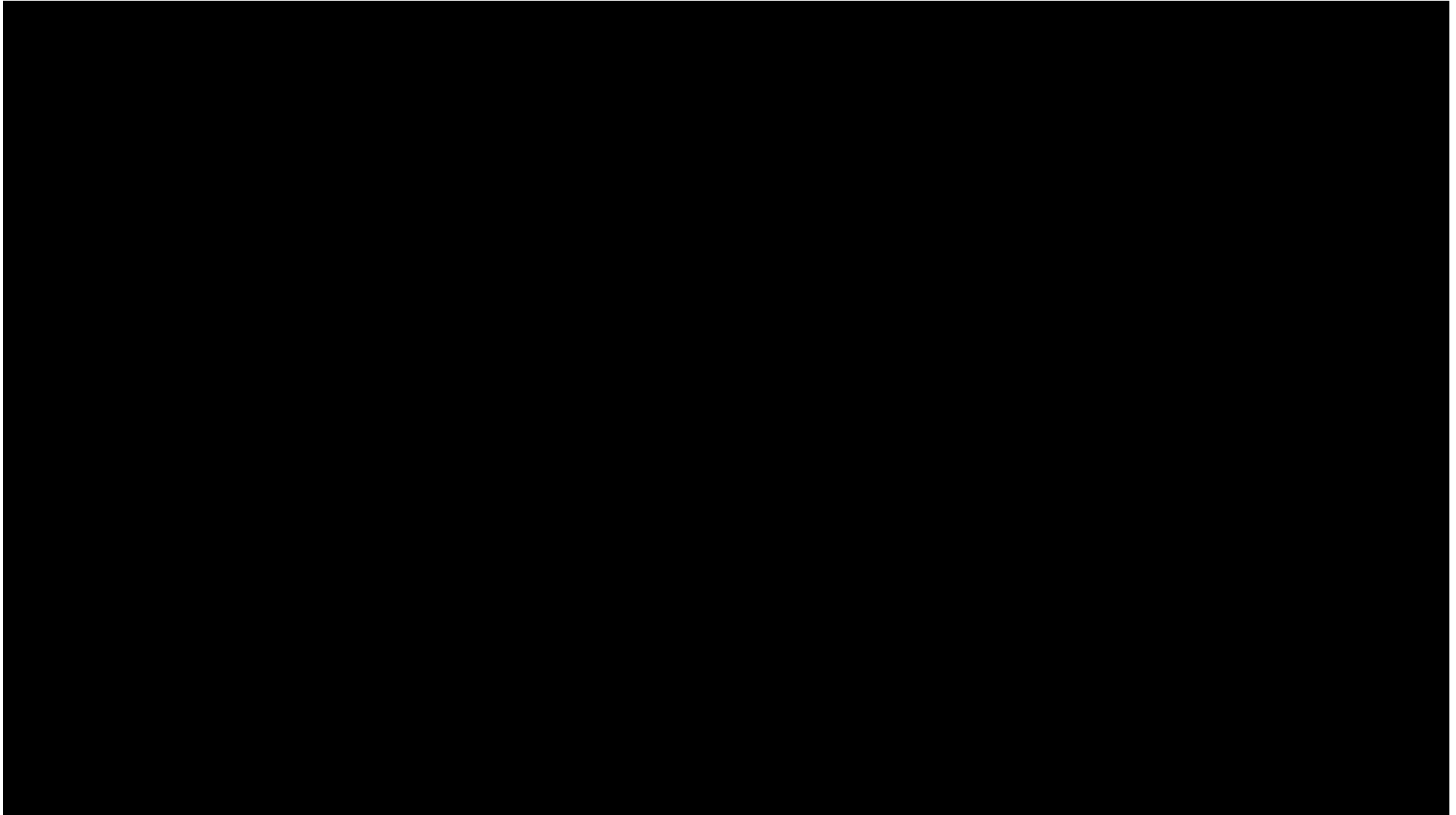
Source: [Azar T \(@wrangulars\)](#): I measured [@GogoWiFi](#) at 37000 ft in air, offered from [@TMobile](#) to it's 1+ customers.

Improving plane data speeds & reducing latency



[Deutsche Telekom and Inmarsat partner to deliver European Aviation Network](#)

European Aviation Network Promotional Video



[YouTube](#)

Improved Connectivity in Planes

2 x 15MHz S band will be used by Deutsche Telekom for complementary coverage through ground network

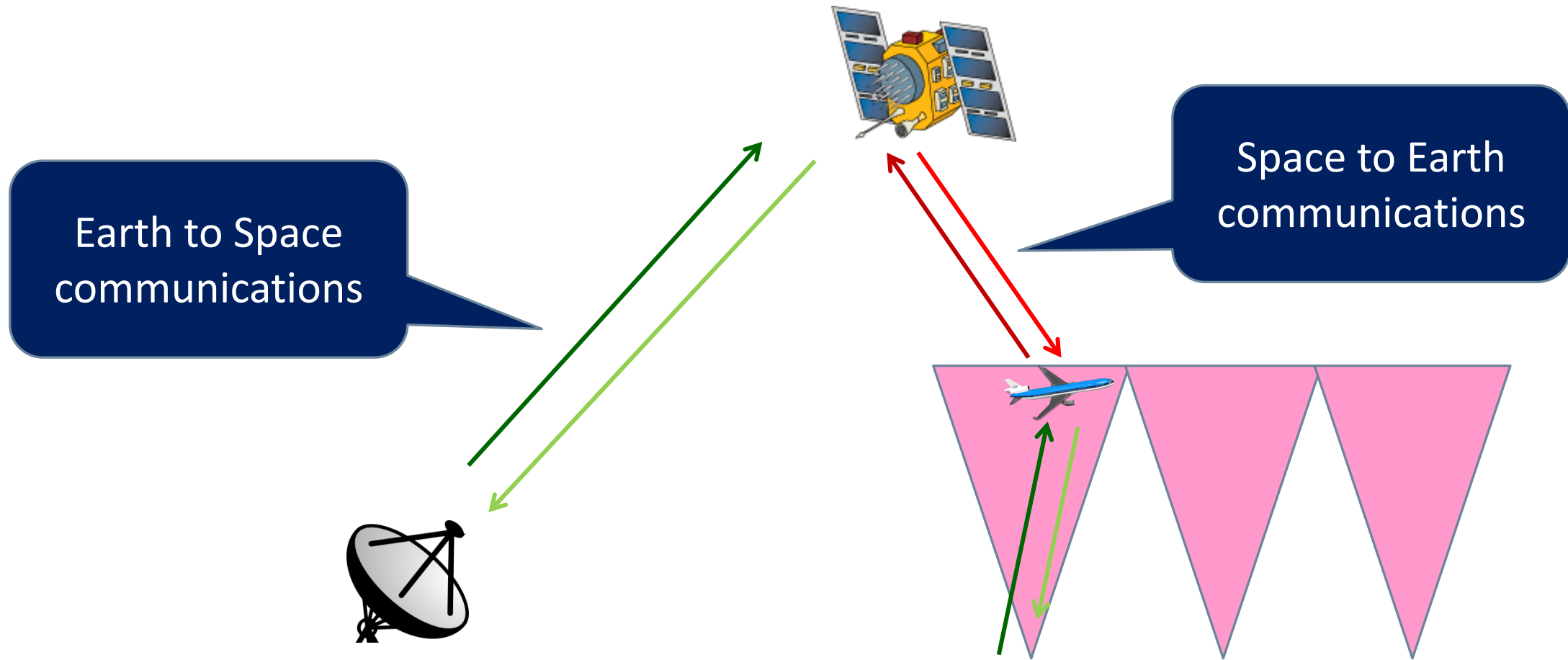
European Aviation Network combines the best of satellite and LTE technology



[Source](#)

- Speeds of up to 75Mbps with same latency as LTE network

Spectrum Management in European Aviation Network



- 2x15MHz pair used for communication in each direction

Goonhilly: Example of Satellite Earth Station



[Source](#)

Thank You

To learn more, visit:

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3G4G Blog – <https://blog.3g4g.co.uk/>

Telecoms Infrastructure Blog – <https://www.telecomsinfrastructure.com/>

Operator Watch Blog – <https://www.operatorwatch.com/>

Connectivity Technology Blog – <https://www.connectivity.technology/>

Free 5G Training – <https://www.free5gtraining.com/>

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